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VOL. XIII, No. 13 1917-18

EXTENSION BULLETIN

Growing 100 Bushels of Corn to the Acre

BY
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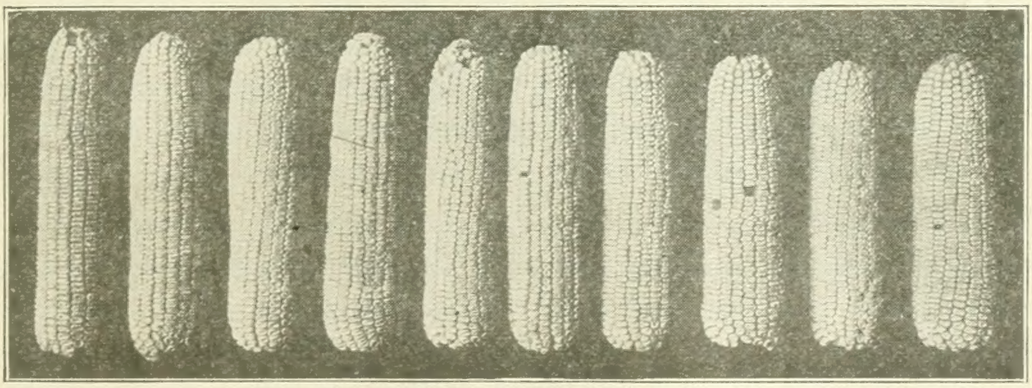

THE OHIO STATE UNIVERSITY, COLUMBUS, OHIO
AGRICULTURAL COLLEGE EXTENSION SERVICE
CLARK S. WHEELER, *Director*

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GROWING 100 BUSHELS OF CORN TO THE ACRE

By Clarence M. Baker

How Ohio farmers can aid in food production, particularly in the raising of corn, is shown in the reports of the Ohio corn champions, Richard E. Simmonds, Hamilton County; Ernest J. Riggs, Gallia County; and Earl L. Johnson, Lake County; all of whom produced during the season of 1917 an average of 100 or more bushels per acre on 10-acre plots. Simmonds grew 103 bushels of shelled corn on each acre at a cost of 19 cents per bushel; Riggs produced 102 bushels per acre at a cost of 20 cents a bushel; and Johnson's yield of 101 bushels approximated a cost of 20 cents per bushel.

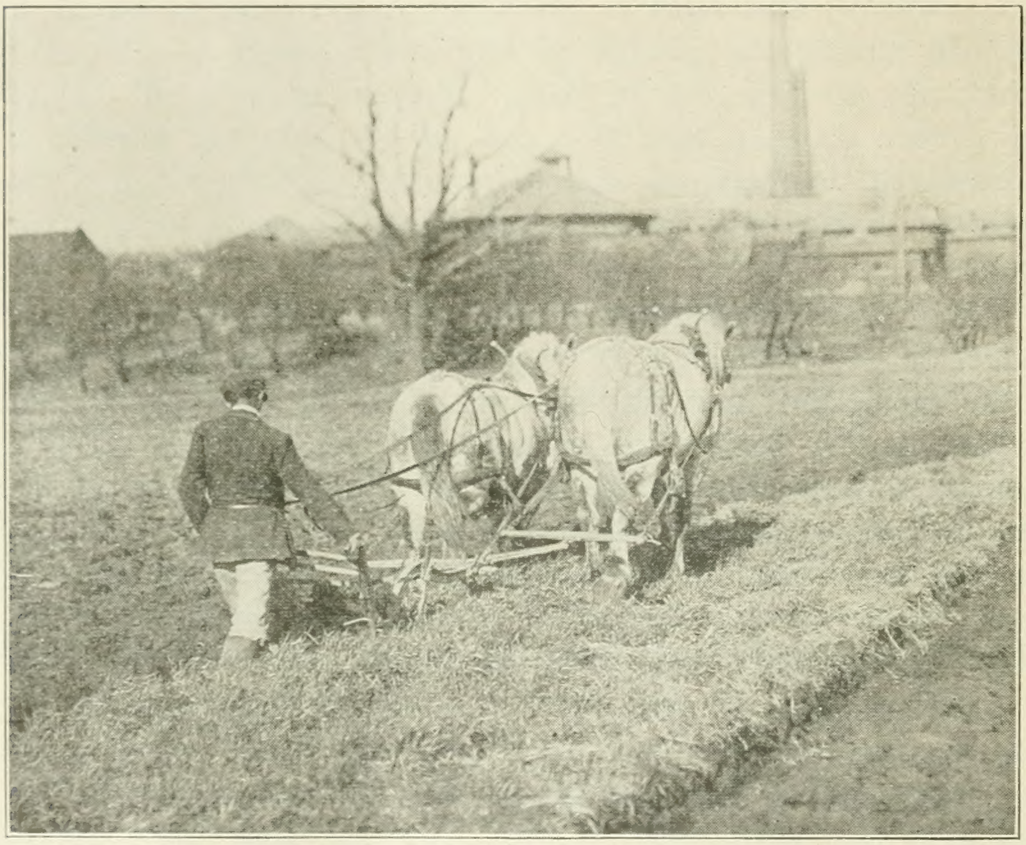
All of these yields were determined from accurate expense and production accounts kept by the winners; all the yields are based on the reduction to a uniform moisture content of 20 percent. In figuring the yields, the weight of corn from 20 shocks was taken from rows running the cross and the long way of the 10-acre plots so that a uniform sample could be secured. The production accounts were based on the cost of plowing, preparing the seed bed, use of fertilizer and manure, cost of seed corn, planting, harvesting, and finally 6 percent interest on the value of the land was added.

Cost account records kept by other farmers enrolled in the 10-acre contest were as high as 57 cents per bushel when the yields were around 60 bushels per acre. The low cost per bushel of the winners is accounted for by the fact that the high yields reduce the cost per unit to such an extent that one may say "the more corn we grow per acre, the cheaper per bushel we can produce it." In other words, the production of extra bushels per acre above the average yield or common yield can be done with unusual returns for extra labor and fertilizers used. If Simmonds had omitted any particular point in his system of corn production so that his yield would have been only 60 bushels per acre, his cost per bushel then would be approximately 40 cents; practically the same thing would have happened in the bushel costs of Riggs and Johnson.

Yields of 100 bushels of corn to the acre are not wholly uncommon in Ohio, yet the fact that the winners produced their crops in three distinct and different sections of Ohio, and under dissimilar conditions, adds considerably to the possibilities of growing more corn per acre in all of the counties of the state. Their own stories tell how the 100-bushels-to-the-acre were produced.

SIMMONDS GROWS SWEET CLOVER IN ROTATION

"I had been winning the Hamilton County trip to Farmers' Week at the Ohio State University for 4 years by producing, in a local corn-growing contest, a yield of 65 bushels to the acre," says Simmonds, who has been growing corn for 37 years. "My corn land," he continued, "is a black sandy loam on a second-bottom slope and of course originally fertile, but due to 100 years' continuous cropping of corn, the yields slowly decreased each year.



A heavy sod, well turned under, is a good foundation for a good corn field

"I always exhibit corn at the local corn shows, and for the past few years won a number of prizes, including several tons of fertilizer. I felt that I must do something to bring up the average production, so I followed the corn crop of 1915 with rye, applying 200 pounds of fertilizer to the acre; sweet clover was sown the next spring and a crop of sweet clover was cut about September 15 following the rye harvest.

"In the spring of 1917, I decided that the 10 acres which had been sown to sweet clover should be used as the field for the 10-acre contest. The spring was late; the first furrow was turned on May 17 when the growth of sweet clover had reached from 24 to 30 inches. With a good job of plowing, however, it was completely turned under. On May 22 the planting was finished.

"Two weeks later I found the sweet clover turned under almost completely rotted and the young corn shoots growing rapidly. I am ashamed to say it, but the 10-acre plot never got more than two workings with the cultivator; the corn grew so fast that by the time for the third working, it was too tall for the riding cultivator. Then a wet season came on which prevented further working with a single-row cultivator.

"The 10-acre plot matured before frost came, but the rest of the bottom ground which had not been sown to sweet clover was late and yielded practically the same average as for the 37 years I have farmed it, 60 bushels."

Simmonds grows Boone County white corn from a strain which he has been developing for a number of years. He always selects his seed from standing corn, picking ears in the glazed stage from the sixth to the eighth joint of a wide-leaved stalk found under at least average conditions. His seed corn is husked directly from the rows and stored in a well ventilated place. The 10-acre plot was drilled, a grain of the graded seed corn being dropped every 15 inches.

RIGGS TURNS UNDER HEAVY GROWTHS OF CLOVER

Riggs also grew his record yield on river bottom land which generally has a sediment deposited on it each year with an overflow of water. Instead of adding fertility as one would expect, the sediment has acted as a hindrance to the production of corn. Being of a heavy, tenacious nature, plowing is rendered slow and tedious and the preparing of the seed bed difficult. Generally this land had to be plowed in the fall to render it workable early in the spring. Consequently this land was plowed in November, 1916, a heavy growth of second crop being turned under to the depth of 9 inches with a tractor.

"On April 18, 1917, we got on the ground with a double disk and drag harrow and went over it twice," says Riggs, who grows on the average of 125 acres of corn each year and finds certain methods must be used in getting ready to grow good corn. "But even the disking and harrowing simply left the field in a lumpy condition, making it necessary to wait for a rain to mellow the soil.

Rain did not come until May 3 and the corn was planted on May 5, this being the usual date of planting in southern Ohio.

"I always aim to drop three grains in the hill and by using graded seed corn in an edge-drop planter I always get a good stand when the germination is good. The plot was harrowed on May 7 and cultivated first on May 15; before the second harrowing, or on June 4, 200 pounds of acid phosphate were sown broadcast with a lime sower. There was a noticeable hastening in the growth of the corn. Another cultivation was given on June 22."

The yields on this plot in former years were around 80 bushels per acre, but even in the 1917 season, which was unfavorable because of the wet growing period, over 100 bushels were produced to the acre. No manure had ever been applied to the plot and it is Riggs' regret that he did not use more acid phosphate. Some of the other fields on the Riggs' farm that have received manure and acid phosphate regularly averaged as high as 116 bushels to the acre.

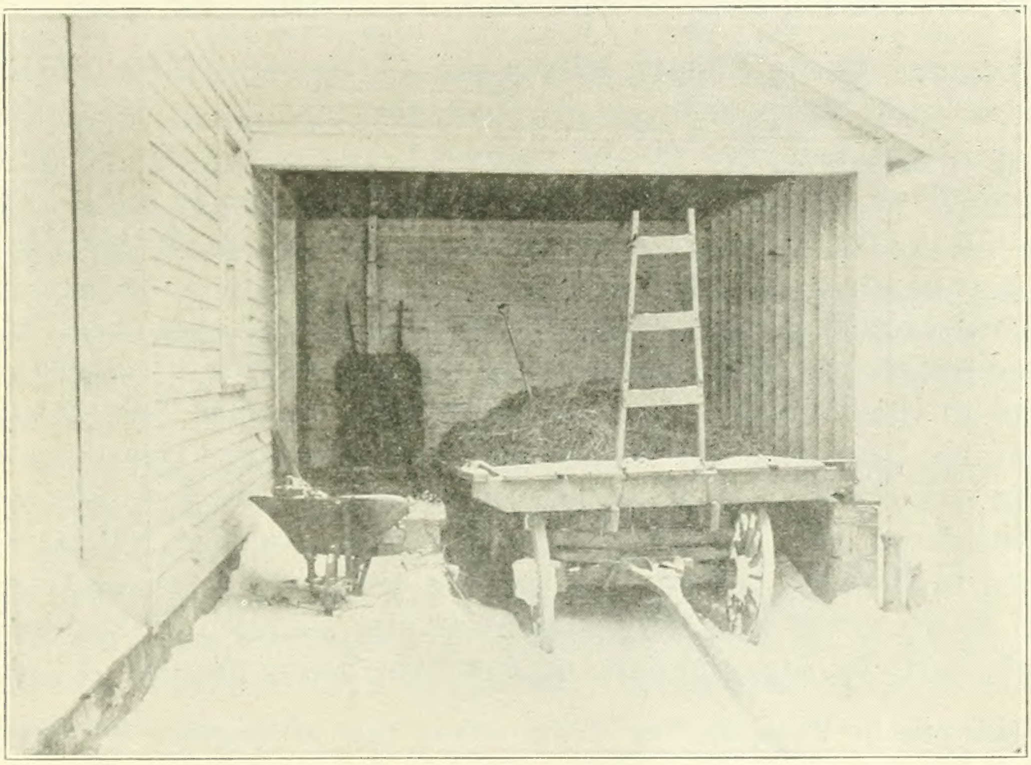
JOHNSON PLOWS UNDER A MANURED ALFALFA SOD

Johnson's management of his 10-acre plot differed from the other winners in the fact that he depended on manure to an unusual extent in growing his crop. The soil in his section probably never had the original fertility that is found in the localities of the other winners. But, in short, the present fertility on Johnson's farm is due to a constructive process of soil building for the past 13 years on the sandy loam slope of what was once the shore of Lake Erie. However, Johnson can tell the story to the best advantage.

"Thirteen years ago I came to Lake County with my father from the East, where dairy farming was practiced extensively. Naturally my father followed the dairy business, being careful to save and utilize all the manure for bringing up the fertility in the soil. The 10-acre field was drained and limed some years ago and was the first plot of land in Lake County to raise a crop of alfalfa; it had produced 3 tons of alfalfa to the acre for each of the past four years. In the fall and winter of 1916-17, I applied 12 tons of manure to the alfalfa sod and this was turned down for corn. The soil was then disked four times and I had arranged to plant it on May 15, but wet weather prevented; on May 30 planting was finished. The corn grew rapidly, being mistaken by observers for ensilage corn; but being a 120-day variety it matured before killing frosts. The plot was cultivated six times—three times with a sulky cultivator and three with a single row cultivator.

"After the corn was cut I noticed particularly how uniform the stand had been; practically every hill had four good stalks. I attribute the good yield to a large extent to the uniform stand, and this was due to the use of graded seed corn of almost perfect germination qualities.

"I regret that I did not use about 400 pounds of acid phosphate to the acre on the plot, as acid phosphate has produced excellent results when used other years. I expect to use it hereafter on all corn land, and also to keep and handle the manure under the conditions that will prevent it from wasting. I regard the manure pit and shed as the best money-maker on the farm."



Johnson regards the manure shed as one of the best money-makers on the farm

Johnson farms 260 acres, of which 40 acres are planted to corn each year, practically the same methods being used on the entire corn crop as on the 10-acre plot. A dairy is operated in connection with the farm; the number of cattle kept often reach 100 head. All the manure produced is hauled directly to the field with a spreader when possible, and during other times it is stored in a concrete pit.

FURNISHING PLANT FOOD FOR A CORN CROP

In considering the practices of the three winners as a guide to corn production in Ohio, the soil fertility in each case gives an idea of what is necessary to produce 100-bushel yields or even yields which will go above the 40-bushel average of Ohio. Johnson plowed down a heavy alfalfa sod which had been covered with 12 tons of carefully saved manure to the acre. Riggs turned under a heavy growth of second-crop clover, and Simmonds plowed down at least 2 tons of green sweet clover to the acre. The fertilizing elements used by a 100-bushel corn crop are: 150 pounds of nitrogen, 50 pounds of phosphoric acid, and 90 pounds of potash. These amounts must be supplied thru manures or fertilizers, if corn is grown year after year, or each year that the corn in grown in rotation. If they are not supplied, and the soil because of its natural fertility or previous treatment produces the maximum yield, the farmer, of course, adds to his income without expense of the fertilizing elements, but the soil becomes that much less fertile each year.

Legume Crops Supply Nitrogen.—Clover or alfalfa contains approximately 40 pounds of nitrogen per ton. Considering that 1½ or 2 tons per acre can be produced, approximately 80 of the 150 pounds of nitrogen are supplied from the clover or alfalfa crop. In addition, the roots of the legume crops contain 40 pounds of nitrogen to the acre, making a total of 120 pounds of nitrogen for the corn crop from one crop of clover or alfalfa, assuming it is plowed under. If fed to livestock, 80 percent of the nitrogen is returned in the manure. Johnson more than supplied the nitrogen for the 100-bushel per acre corn crop by plowing down the 4-year-old alfalfa sod and by adding 12 tons of manure to the acre. It must be considered, too, that his land had never produced 100 bushels of corn to the acre before. By turning under the 2-ton growth of green sweet clover, the 150 pounds was also supplied by Simmonds and similarly by Riggs in plowing down the heavy growth of clover.

Manure is Valuable for Corn.—One ton of manure which has been cared for properly contains 10 pounds of nitrogen, 5 pounds of phosphoric acid and 10 pounds of potash. Applying 10 tons of manure to the acre then will also aid in supplying the other fertilizing elements necessary for growing a 100-bushel corn crop to the acre. On the Johnson farm the stables have concrete floors and the manure is usually hauled directly to the field and spread. This allows but little chance for loss of fertilizing constituents. The manure that cannot be hauled immediately is kept in concrete pits. In this way leaching in prevented. All manure is applied with a spreader, usually, at the rate of 12 tons to the acre.

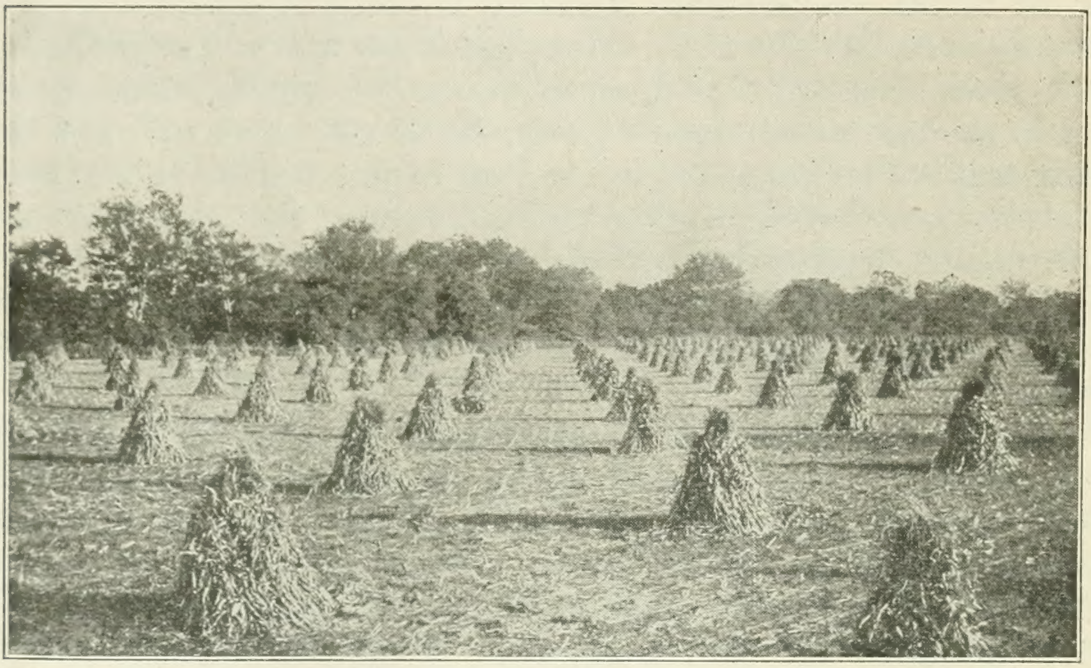
Johnson follows a short rotation on the heavier clay soil of the farm, but the meadows are never left more than 1 or 2 years, as unusual importance is attached to having a heavy sod as a forerunner for the corn crop. The experience on this farm could easily influence more farmers to plan for short rotations and good sods in growing corn. Then, too, when manure is applied to heavy sods of clover, alfalfa or mixed hay, an almost ideal foundation is laid for the corn crop. This year the breaking up of heavy sods will be good practice rather than 2 or 3 years hence when they will be of much poorer quality.

Acid Phosphate Balances Available Nitrogen and Potash.—To balance the available nitrogen and potash liberated thru the decay of organic matter, it is advisable to apply phosphorus in commercial form. For this purpose acid phosphate is used more extensively than any other one material. From their experience in corn growing, all of the winners have prepared to add acid phosphate hereafter, Johnson figuring than 400 pounds to the acre will be profitable in his case. Generally, acid phosphate can be applied with a grain drill to the best advantage. In this way it will be spread over the entire field rather than just in the corn rows. Applied in this way it favors a better root distribution, thus helping the plants not only to withstand dry weather better, but also to produce ears that are heavy and early in maturing. Whatever is left after the corn crop has helped itself will be well distributed for the crop which follows.

Riggs' experience of a sudden growth when the fertilizer high in acid phosphate was applied to the growing corn, is evidence of the value of phosphorus to corn. The matter of applying the phosphate after the corn has had several weeks' growth in not uncommon in Ohio, and is practicable when it is impossible to get the fertilizer in before the corn is planted. A lime or fertilizer sower, however, can be used.

Acid Phosphate Returns from 700 to 1000 Percent on Investment.—Experimental evidence as furnished by the Ohio station, Wooster, shows the value of the system outlined in corn growing. The use of manure alone on clover sod has resulted in average yields of 59 bushels of corn per acre; but where 320 pounds of acid phosphate were used in addition to the manure, the yields have been increased to 71 bushels per acre. Every ton of acid phosphate used in this way has produced 75 bushels of corn. This does not represent the total value of each ton used, as the residual effect on the wheat and clover caused an increase of 34 bushels of wheat, and 3 2/3 tons of clover hay. Figuring that corn is worth $1 per bushel, wheat $2 and clover hay $20 per ton, 1 ton of acid phosphate returned crops worth $216. A ton of acid phosphate will cost now from $22 to $25, but every dollar expended for acid phosphate will return from $7 to $10 in crops, judging from records of the Ohio Experiment Station. Can a farmer afford to omit it from the soil when preparing for the corn crop?

Liming Increases Corn Yield.—For many years the soils of Lake County, where Johnson lives, have been acid. Riggs uses lime in practically every rotation, which accounts for the heavy growths of clover that he can turn down for the corn crop. Simmonds lives in a section in which the soil is still sweet from the disintegrating limestone. A sweet soil made it possible to grow a rank crop of sweet clover, which in turn supplied the nitrogen for the corn crop. Johnson has been liming for several years, and of course could grow the heavy crops of clover and alfalfa not possible where liming is left out of the soil-building system. The fact that alfalfa and clover are total failures in some sections indicate that the soil calls for lime; and the corn grower who cannot grow the heavy sods will find it profitable to use lime this season. Not only will it be possible to grow clover and alfalfa then, but results from using lime at the Ohio Experiment Station show an increase of 10 bushels per acre over corn from unlimed land.



An even stand on well prepared sod results in large and uniform-sized shocks

Ground limestone at the rate of 2 tons per acre is used by Johnson, because he believes the power to destroy acid soils can be purchased in ground limestone more economically than it can in hydrated or quicklime.

Deep, Compact Seed Beds Best for Corn.—Soil built to a high standard of fertility is not the only factor necessary in producing profitable yields of corn, as shown by the experience of the winners. Because the soil is always heavy, Riggs plows in the fall and then depends on several double diskings to get the soil ready for planting. Johnson disked his plot four times before it suited his fancy as a seed bed. Simmonds had to work under the heavy growth of sweet clover before he was ready to plant. A deep, compact seed bed is the ideal of the winners. They believe in plenty of horse or tractor power, so that valuable time in preparing the seed bed can be utilized to its best advantage. Riggs uses a tractor, plowing both night and day if necessary to get his crops in; however, the soil is never touched when too wet. A liberal allowing of power makes it possible to do the best work at the right time.

Testing Seed Corn is a form of Crop Insurance.—Testing seed corn is regarded by the winners as one of the important factors in securing a good stand after one has selected a variety well adapted. All of the men practice the individual ear test either with the "germination box" or the "rag doll" method, throwing out all ears that fail to produce 6 sprouted grains. Simmonds always selects his own corn (Boone County White), Riggs also grows his own seed (Reid's Yellow Dent), and Johnson selects an early maturing variety, since the seasons are shorter than in more southern portions of the state, or gets his seed corn from his neighbors if he does not produce it himself each year. Seed grown at home or close to home is generally adapted to soil and climatic conditions.

Johnson Uses Box Method.—For testing seed ears, Johnson uses a box 28 inches long, 20 inches wide and 4 inches deep, which will hold the test grains from sixty ears, or enough to plant 4 acres. The box is filled to a depth of 2 inches with thoroly wet sawdust or sand; then a piece of heavy muslin ruled into 2-inch squares and numbered from 1 to 60 is placed over the wet sand or sawdust to receive the corn.

Six grains taken from different parts of each ear are placed in the square corresponding to the ear tag; the ears are numbered by a paper tag held firmly to the pith of the cob by a nail. After the grains are arranged another piece of muslin a little larger than the box is placed over the squares; then the box is filled level full of wet sawdust or sand.

By keeping the box in an ordinary living room temperature where there is no danger of freezing, Johnson finds that in from

8 to 10 days the test is completed and can be easily read by removing the upper layer of the box. Ears that do not show six vigorous sprouts are not retained for seed. The sawdust may be used repeatedly, but it is usually necessary to sterilize the cloths and even the sawdust by boiling in water to prevent molds from growing.

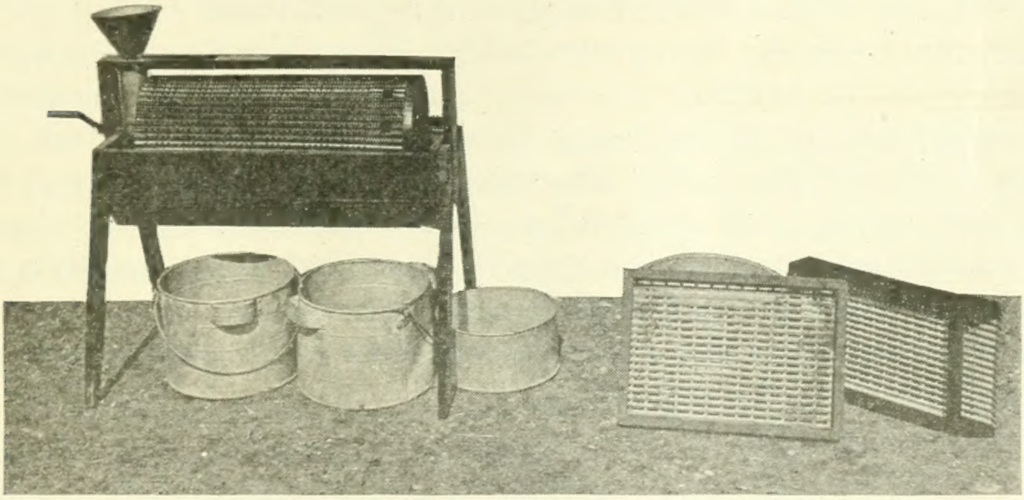
Rag Doll Method is Simple.—Simmonds uses the rag doll tester, which consists of two strips of heavy muslin 10 inches wide and 5 feet long. One strip is stretched on a table and ruled into 2½ inch squares, making two rows of 15 squares each. This provides space for testing thirty ears.

After thoroly wetting the ruled cloth, six kernels are taken from each ear as in the box method, but all the tips point to one side with the germ side of the kernel up. The other piece of muslin is then soaked and laid over the grains to hold them in place. The two strips are carefully rolled together, beginning from one end. The "doll" is then tied with a string to keep from unrolling and placed in a bucket of warm water for from 8 to 10 hours. Then the water is drained and the "dolls" allowed to remain in the bucket with the tips of the kernels pointing downward. By keeping the rolls in ordinary living room temperature the test will be ready for reading in 8 days. The muslins used in making the rag doll test are used repeatedly by Simmonds, but are sterilized in boiling water after every test to avoid molds.

Graded Seed Corn Gives Uniform Stand.—All of the winners grade the seed corn, using a hand machine which can be secured for about $1.50. After the corn is graded the plates of the planter handle the grains with much more uniformity in regard to the number to drop in a hill. The kernels of odd sizes are eliminated and a more uniform stand is assured. The use of seed that was well stored, tested, and graded gave a stand in the cases of the three winners which made possible a production of 1000 bushels of shelled corn on 10 acres.

Simmonds always drills his corn, due to the fact that cultivation has always been easy on his sandy soil; weeds, too, are not hard to control. Where the weed problem is serious the cultivation of drilled corn is more expensive. Corn planted in hills is more easily hand-harvested than in drills, while drilled corn is handled to a better advantage by the corn harvester. Riggs always finds it necessary to check his corn in order to cross cultivate; pea vines and other troublesome weeds common to bottom soil must be controlled each season. Johnson always plants in hills. Simmonds sets the planter to drop one grain every 15 inches in rows 42 inches wide. The other winners check in hills 42 inches apart.

Figures given out by the Ohio Experiment Station on the rate of planting based on a 10-year average aid in helping one to determine about the number of grains to plant when the corn is checked. For instance, only one plant to the hill would give a total of 3,555 plants to the acre; such a stand has given an average yield for 10 years at the Ohio Station of 32 bushels of shelled corn to the acre. Where two stalks per hill were secured, the yield was 51 bushels; an average of three plants to the hill made a total of 10,665 plants to the acre, with a yield of 61 bushels. Four plants per hill or 14,220 to the acre made an average yield of 65 bushels; when five plants to the hill were secured, making a total of 17,775 to the acre, the yield in bushels was 63, indicating that five plants to the hill is too thick. The percent of nubbins, too, with the five-plant hills was 43 as compared with 31 percent when four grains were dropped to the hill.



Seed corn graders insure uniform planting

Riggs always aims to drop three grains to the hill and Johnson four; the actual difference in the yields between the two rates are not so much, but possibly the three-plant rate will produce ears of higher class than the four-plant rate. If the crop is to be fed from the shock, then the smaller ears and the greater abundance of forage as produced by the thicker rates of planting are the more desirable.

Early Plantings Give Highest Yields.—Johnson aims to plant during the second week in May; Riggs from May 1 to 5 and Simmonds by May 15; frequently weather conditions make it impossible to observe these dates. At the Ohio Station a 6-year average of yields based on different dates of planting will aid in determining the best time to plant. Corn planted from April 24 to 29 has averaged 64 bushels to the acre; May 4 to 10, 69 bushels; May 14 to 17, 67 bushels; May 25 to 28, 55 bushels and June 2 to 6, 44 bushels. The largest average yields were secured from planting May 4 to 10, and larger yields from planting on April 25 than May 25. Corn planted the first days of May has given a yield of shelled corn considerably greater than corn planted during the first days of June. Evidently, then, there will be greater loss in yields from a tendency towards late planting rather than planting too early.

Cultivate to Kill Weeds.—Both Johnson and Simmonds plan to use a weeder on their corn ground several times before the shoots appear, thus destroying an unusual number of sprouting weeds and also maintaining a mulch on the surface. Riggs accomplishes the same result by harrowing. Riggs and Johnson cultivate at least three times with a sulky worker and several times with a one-row cultivator when the corn grows taller. When the weeds are troublesome it is the practice of most farmers to cultivate frequently; however, Simmonds not being troubled with weeds does not cultivate so often. The fact is observed by the winners, too, that when the corn plants have plenty of available food, such as was the case of the Simmonds' plot, the growth is so fast as to insure a good supply of moisture and food despite cultivation. In other words the corn roots develop so easily and fast that they secure what they want.

THE WORLD NEEDS CORN.
OHIO FARMERS CAN RAISE IT.

To increase the average production of corn per acre in Ohio is the problem which faces the farmers of the state. To grow more corn will not only bring more money into the hands of farmers, but will also produce more food, which is needed in wartime. To appreciate the industrial and economic conditions that affect the farming business is to understand the difficulties that are to be overcome in increasing the average yield of Ohio's corn crop. Ohio farmers will do their share.

More corn will also mean an increase in the number of hogs for the army pork demands. More corn will be a favor to the entire allied cause. Aside from profit, those who produce more corn than usual will feel the advantage of having contributed in a material way to the feeding of the national and allied armies. The allied cause will gain because of the increased meat for food and fats for industrial purposes. Not all of the corn produced will be fed to hogs or to other food producing animals. Part of it will be needed for human consumption as a substitute for wheat.

Cornmeal can not be shipped across the water, because when stored in bulk it becomes rancid due to its high content of oil. Moreover, the foreign system of cooking is not adapted to the making of quick breads. Soldiers need wheat; corn is the logical cereal to use at home when the supply of flour is limited for army rations.

The corn crop of 1918 must be large enough to meet the increased demand for corn until the 1919 crop is available. This year's crop is of vital interest at present; perhaps 1919's crops will be more important. But as long as the war lasts and for several years afterward, during the reconstruction period, the need for food will continue. Constructive practices in corn growing then will be as valuable for several years to come as at present; a consideration then of factors that will utilize labor, fertilizers and cultural methods to the best advantage in corn production is important. Methods used by farmers are largely of their own choosing, but those methods which will give the best results should be kept in mind.

M. A. BACHTELL.